

QUAIL CREEK RESERVOIR



Introduction

Quail Creek Reservoir is a large impoundment of Quail Creek and several tributaries in extreme southwestern Utah. This reservoir provides drinking water to St. George and offers many recreational opportunities. At 12:08 a.m. on January 1, 1989 the southwest dike

finally failed and unleashed a wall of water, forty feet in height, downstream. The torrent of water, estimated at 25,000 acre-feet, forced the evacuation of some downstream residents, and caused fairly extensive property damage. The dike had been plagued by leakage since its completion in 1985, but was considered safe until shortly before the flows began to increase prior to its collapse. The leakage was due in large part to the solubility of gypsum found in the soil which dissolved and produced conduits for the transmission of water in the

Characteristics and Morphometry

Lake elevation (meters / feet)	910 / 2,985
Surface area (hectares / acres)	239 / 590
Watershed area (hectares / acres)	239,816 / 592,577
Volume (m ³ / acre-feet)	
capacity	238.7 / 40,325
conservation pool	370,000 / 300
Annual inflow (m ³ / acre-feet)	2.71 x 10 ⁸ / 22,000
Retention time (years)	1.84
Drawdown (m ³ / acre-feet)	4.5 / 15
Depth (meters / feet)	
maximum	58 / 190
mean	20.8 / 68.3
Length (meters / feet)	2,476 / 8,125
Width (meters / feet)	1,485 / 4,872
Shoreline (meters / feet)	12,214 / 40,071

Location

County	Washington
Longitude / Latitude	113 22 49 / 37 10 51
USGS Map Harrisburg Junction, UT (not on map) 1986	
DeLorme's Utah Atlas and Gazetteer™ Page 17, D-4	
Cataloging Unit	Upper Virgin (15010008)

area. Several attempts were made to reduce and control the flow past the dike but new leaks continued

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to appear. The leakage increased significantly on Saturday prior to the failure. Work crews battled for 14 hours to seal the leak in the earthen dike including efforts to pump concrete grouting into the toe of the dike. Despite efforts the situation got progressively worse. By 10:00 p.m. on New Years Eve, it was apparent that failure of the dike was eminent. Although New Years Eve celebrations caused some difficulties efforts to warn residents and conduct needed evacuations worked well and ran smoothly which prevented injury and the loss of life. Some livestock was lost in addition to property damage as water sweep into fields in the Washington area.

The reservoir shoreline is publicly owned and public access is unrestricted. The reservoir is built between two hogbacks of the Harrisburg Dome. Quail Creek has cut a notch, Harrisburg Gap, in the more prominent hogback. The reservoir was created by building earth-fill dams were constructed in the strike valley to the southwest and in Harrisburg Gap itself. Construction was initially completed in 1984. However, after the collapse in 1989 the southwest dike was reconstructed utilizing a design strategy more conducive to the geological conditions and soils in the area. Currently, water is used for both municipal/industrial purposes and irrigation, but as growth in the St. George area continues without water conservation measures, all of the water will be required for municipal/industrial purposes.

Recreation

Quail Creek Reservoir is on U-9 about 3 miles east of I-15 (at exit 16) and 4 miles west of Hurricane. The reservoir offers many recreational opportunities, including fishing, boating, camping, and swimming. Because of the low elevation and southern location, winter temperatures are mild and the recreation season extends from early spring to late fall.



Quail Creek State Park is on the south side of the reservoir and is accessible from U-9. Facilities include 23

campsites, an improved boat ramp, modern toilets, a fish cleaning station and two covered picnic areas. Usage fees are charged in all areas of the park.



Watershed Description

Quail Creek Reservoir is located on the desert floor between two hogback ridges. The ridges trend north-east/south-west, with Quail Creek cutting through them. To the northwest, the topography rises steeply into the Pine Valley Mountains. The outlet is immediately upstream from the confluence of Quail Creek and the Virgin River.

The watershed rises steeply to the west into the lava-capped Pine Valley Mountains (technically a plateau). Streams carry runoff from snowmelt down the mountainside and immediately into the reservoir. Most valley reservoirs are eutrophic; Quail Creek, owing to its close proximity to the stream sources, is not. It is also a relatively new reservoir, so nutrient-rich sediments have not yet accumulated in quantity.

The watershed high point, Signal Peak, is 3,159 m (10,365 ft) above sea level, thereby developing a complex slope of 14.9% to the reservoir. The inflows are Quail Creek and Cottonwood Creek and the outflow immediately enters the Virgin River. The average stream gradient above the reservoir is 8% (422 feet per mile) for Quail Creek and 1.3% (68 feet per mile) for the East Fork of the Virgin River. Upstream impoundments include Kolob Creek Reservoir and Blue Springs Reservoir.

The area surrounding the reservoir is mostly bare rock and desert soils, while much of the watershed is comprised of soils typical of steep, vegetated slopes at low to high elevations.

The vegetation communities are comprised of shadscale, greasewood, saltbrush, sage-grass, bitterbrush-mountain mahogany, pinyon-juniper, mahonia, grass-forbes, pine, aspen, spruce-fir, oak, and maple. The watershed receives 25 - 76 cm (10 - 30 inches) of

precipitation annually with a frost-free season of 180 - 200 days at the reservoir.

Land use is nearly 100% multiple use, with some urban and agricultural development in Leeds. Much of the watershed is in the Dixie National Forest. The major use of the watershed is livestock grazing, much of which is overgrazed, resulting in heavy runoff and substantial soil erosion. The highest areas of the watershed are a federally protected wilderness area.

Limnological Assessment

The water in Quail Creek Reservoir is of fairly good quality. The water is considered very hard with a hardness concentration of 415 mg/L (CaCO_3). The alkalinity and conductivity, as is expected are also relatively high. These values increase in the reservoir as naturally occurring gypsum (Ca_2SO_4) in the sediments dissolves. Although there are no overall water column concentrations that exceed State water quality standards dissolved oxygen concentrations do decline through the water column and reach low concentrations that are an impairment to the fishery at times. In May of 1991 total phosphorus values averaged 41 ug/L near the dam site which exceed the state pollution indicator value of 25 ug/L. Typically total phosphorus concentration are well below the indicator value as summarized in the limnological data table. Although phosphorus concentration is relatively low nitrate/nitrite concentrations appear fairly stable at concentrations near 0.2 mg/L.

Current data suggest that the reservoir is currently a phosphorus limited system. TSI values indicate the reservoir is oligotrophic to low mesotrophic in a state of low productivity. The reservoir does stratify as indicated by the profile from August 8, 1991. Below the thermocline there is a marked decline in the concentration of dissolved oxygen.

Limnological Data

Data averaged from STORET sites: 494035, 494036, 494037

Surface Data	1989*	1990**	1991
Trophic Status	O	M	M
Chlorophyll TSI	34.58	36.75	35.78
Secchi Depth TSI	47.09	46.53	42.01
Phosphorous TSI	17.35	48.38	43.28
Average TSI	33.00	43.89	40.35
Chlorophyll <i>a</i> (ug/L)	1.5	1.9	1.7
Transparency (m)	2.5	2.6	3.5
Total Phosphorous (ug/L)	3	21	16
pH	7.7	8.1	8.1
Total Susp. Solids (mg/L)	-	6.5	<3
Total Volatile Solids (mg/L)	-	-	8
Total Residual Solids (mg/L)	-	-	13
Temperature ($^{\circ}\text{C}$ / $^{\circ}\text{F}$)	19/65	26/80	20/66
Conductivity (umhos.cm)	1110	1003	930

Water Column Data

Ammonia (mg/L)	0.04	0.03	0.03
Nitrate/Nitrite (mg/L)	-	-	0.23
Hardness (mg/L)	-	422	408
Alkalinity (mg/L)	-	125	136
Silica (mg/L)	-	-	9.1
Total Phosphorous (ug/L)	3	13	17

Miscellaneous Data

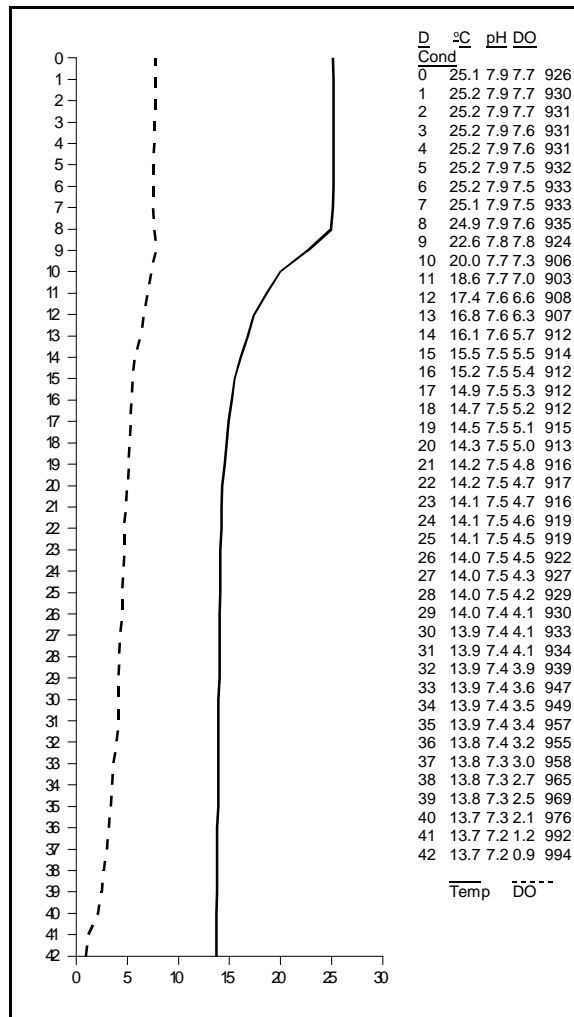
Limiting Nutrient	N	N	P
DO (Mg/l) at 75% depth	-	0.6	4.0
Stratification (m)	-	10-12	8-12
Depth at Deepest Site (m)	-	23.6	42.0

* Spring data only ** Summer data only

There are profiles documenting fairly extensive anoxic conditions present in the hypolimnion. The extensive loss of dissolved oxygen in the water column may be due in part to the oxidation of nitrogen in the system.

According to DWR no fish kills have been reported in recent years. The reservoir supports a population of rainbow trout (*Oncorhynchus mykiss*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and Threadfin shad (*Dorosoma petenense*). Current stocking reports indicate that DWR stocks the lake with 25-50,000 subcatchable rainbow trout. The reservoir has not been chemically treated by the DWR to control rough fish competition, so the reservoir could contain some of the original fish populations of Quail Creek and the Virgin River. Phytoplankton in the euphotic zone include the following taxa (in order of dominance)

Species	Cell Volume%	Density
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Pollution Assessment

Nonpoint pollution sources include: sedimentation and nutrient loading from grazing and feed yards, potential mine wastes from abandoned mines and wastes or litter from recreation. Cattle graze in the watershed.

There are point pollution sources in the watershed. They are located primarily in the upper watershed of the Virgin River.

Beneficial Use Classification

The state beneficial use classifications include: culinary water (1C), recreational bathing (swimming) 2A, boating and similar recreation (excluding swimming) (2B), warm water game fish and organisms in their food chain (3B) and agricultural uses (4).

Information

Management Agencies

Utah Parks and Recreation	538-7722
Quail Creek State Park	879-2378
Bureau of Land Management	539-4001
Dixie Resource Area (St. George)	673-4654
Five County Association of Governments	673-3548
Division of Wildlife Resources	538-4700
Division of Water Quality	538-6146

Recreation

Color Country Travel Region (St. George)	628-4171
Saint George Area Chamber of Commerce	628-1658

Reservoir Administrators

Washington County Water Conservation District	673-3617
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	(mm ³ /liter)	By Volume
<i>Sphaerocystis schroeteri</i>	2.641	93.22
<i>Dinobryon divergens</i>	0.104	3.68
<i>Oocystis sp.</i>	0.050	1.77
Pennate diatoms	0.017	0.59
<i>Scenedesmus bijuga</i>	0.016	0.55
Centric diatoms	0.003	0.11
<i>Chlamydomonas globosa</i>	0.000	0.00
	0.08	

Total 2.831

Shannon-Weaver [H']	0.33
Species Evenness	0.17
Species Richness	0.31

The flora dominated by green algae, which indicates a fairly healthy aquatic ecosystem. Algal biomass is not great enough to be a problem.

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